What is Frequency Modulation?

Frequency modulation (FM) is the method of conveying informations over a carrier wave by varying its frequency .This is different from the **Amplitude Modulation (**AM) in which the amplitude of the carrier wave is varied while its frequency remains constant. FM broadcasting is a broadcast technology invented by **Edwin Howard Armstrong** to provide high-fidelity sound transmission over broadcast radio. The history of FM dates back to 1936 when Edwin Howard Armstrong described the FM frequency as a method of **reducing disturbances** in radio transmission in a conference of **Radio Engineers New York** in November 6, 1936.

FM frequency is widely used in **telecommunication devices** to transmit voice without disturbances. In analog applications, the instantaneous frequency of the carrier is directly proportional to the instantaneous value of the input signal. Digital data can be sent by shifting the carrier's frequency among a set of discrete values, a technique known as frequency-shift keying.

Features of FM signals

1. The most important feature of frequency modulation is its **resilience** to signal level variations. The modulation is carried only as variations in frequency. That is, any signal level variations will not affect the audio output, provided that the signal does not fall to a level where the receiver cannot cope.

2. FM wave has property of resilience to noise and interference. It is for this reason that FM is used for high quality broadcast transmissions.

3. Another important feature is related to FM transmission. It is possible to apply the modulation to a low power stage of the transmitter, and it is not necessary to use a linear form of amplification to increase the power level of the signal to its final value.

4. For FM transmission, it is possible to use non-linear RF amplifiers to amplify FM signals in a transmitter. This is more efficient than the linear RF amplifier Therefore, for a given power output, less battery power is required.

Concept

To generate the FM signal, the frequency of the radio carrier must be **changed in line** with the amplitude of the incoming audio signal. When the audio signal is modulated on to the radio frequency carrier wave, the new radio waves move up and down in frequency. The rate at which the wave moves up and down is known as **“Deviation”** and is represented as **Kilohertz deviation**. For example, if the signal wave has a deviation of 4 kHz, then the carrier wave is made to move in 4 kHz. VHF transmission generally uses band between **88 to 108 MHz** with large deviation of **75 kHz.** This deviation is known as **‘Wide band FM** or WBFM. These signals have large bandwidth and support good

quality broadcasting. Less band width is used in FM communication systems. Two way communication systems uses narrow band FM with a deviation of 3 kHz.

FM Transmission

FM is commonly used at VHF radio frequencies for high-fidelity broadcasts of music and speech. Normal TV sound is also broadcast using FM. The FM band used in broadcast is generally called wide-FM, or W-FM. In two-way radio, Narrowband-FM (N-FM) is used to conserve bandwidth. In addition, it is used to send signals into space.

The Wideband FM (W-FM) requires a **wider signal bandwidth** than amplitude modulation by an equivalent modulating signal, but this also makes the signal more robust against noise and interference. Frequency modulation is also more robust against simple **signal amplitude fading** phenomena. FM receivers employ a special detector for FM signals and exhibit a phenomenon called **Capture effect,** where the tuner is able to clearly receive the stronger of two stations being broadcast on the same frequency. An FM signal can also be used to carry a stereo signal. However, this is done by using multiplexing and demultiplexing before and after the FM process, and is not part of FM proper.

Throughout the world, the broadcast band falls within the VHF part of the radio spectrum. Usually 88 – 108 MHz is used. The range of an FM mono transmission is related to the transmitter RF power, the antenna gain and antenna height.

For FM stereo, the maximum distance covered is significantly reduced. This is due to the presence of the 38 kHz sub carrier modulation. Vigorous audio processing improves the coverage area of an FM stereo station.